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1. Your reference — PHGB030135GBQ

2. Patent application number
(The Patent Office will fill in this part) — 1 1 AUG 2003 — 0318735.8

3. Full name, address and postcode of the or of each applicant (*underline all surnames*)

KONINKLIJKE PHILIPS ELECTRONICS N.V.
GROENEWOUDSEWEG 1
5621 BA EINDHOVEN
THE NETHERLANDS

Patents ADP Number (*if you know it*) — 07419294001

7419294OC

If the applicant is a corporate body, give the country/state of its incorporation — THE NETHERLANDS

4. Title of the invention — COMMUNICATION SYSTEM

5. Name of your agent (*if you have one*)

"Address for service" in the United Kingdom to which all correspondence should be sent (*including the postcode*)

Philips Intellecual Property & Standards
Cross Oak Lane
Redhill
Surrey RH1 5HA

Patents ADP number (*if you know it*) — 08359655001

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Country	Priority Application number	Date of filing

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Number of earlier application	Date of filing (*day/month/year*)

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? (*Answer "Yes" if:*
a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is not named as an applicant, or
c) any named applicant is a corporate body.
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Patents form

Patents Form 1/77

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Continuation sheets of this form	
Description	3
Claim(s)	0 CF
Abstract	1
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Statement of inventorship and right to grant of a patent (*Patents Form 7/77*)	
Request for preliminary examination and search (*Patents Form 9/77*)	
Request for substantive examination (*Patents Form 10/77*)	
Any other documents (*Please specify*)	

11. I/We request the grant of a patent on the basis of this application.

Signature P.J Mabey Date 11/8/03

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Notes

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DESCRIPTION

COMMUNICATION SYSTEM

Terminals in mobile communication systems usually have a maximum transmit power limit, which may be set by physical constraints or in response to an instruction received from a controller.

While a terminal is transmitting a first signal, it is sometimes necessary to transmit additional signals which would require the terminal's maximum transmit power limit to be exceeded. In such cases, a variety of approaches may be taken, including: reduce the transmit power of the first signal in order to allow sufficient power for the additional signal(s) to be transmitted without breaching the maximum power limit; switch off part or all of the first signal in order to allow the additional signal(s) to be transmitted.

In some systems, it is only possible to execute the reduction in transmit power of the first signal at particular time instants, such as a frame- or timeslot-boundary. These time instants may not correspond to the times at which the transmission of the additional signal(s) must commence. Consequently it may be necessary to execute the reduction in transmit power in advance of the transmission of the additional signal(s).

In such situations, the exact nature of the additional signal(s) may not yet be known at the time when the reduction in transmit power of the first signal has to be executed. Different types of additional signal may have different transmit power requirements.

According to the present invention, the transmit power of the first signal is reduced by an amount equal to the greatest power requirement of any of the set of possible additional signals which may be subsequently transmitted.

This avoids setting a requirement on the terminal to make an earlier decision about which type of additional signal is to be transmitted, or to make a

reduction in power of the first signal at some time other than the most convenient instant.

In one embodiment of the present invention, a UMTS mobile station (MS) transmits some continuous uplink (UL) signals to a base station (BS). The MS also receives some downlink (DL) packet data, typically using the High-Speed Downlink Packet Access (HSDPA) feature of UMTS. The MS must transmit a positive (ACK) or negative (NACK) acknowledgement for each HSDPA packet received, depending for example on the outcome of a CRC evaluation. The ACKs and NACKs are transmitted on a so-called High-Speed Dedicated Physical Control Channel (HS-DPCCH), whose timeslots are not aligned with the timeslots on the other uplink channels carrying the continuous uplink signals.

If the transmission of an ACK or NACK in parallel with the continuous uplink signals would require more transmit power than is available, the transmit power of the other uplink channels is reduced at the timeslot boundary immediately preceding the start of the ACK or NACK transmission. However, in UMTS HSDPA, the transmit power for ACKs may be required to be different from the transmit power for NACKs. Consequently, if the MS were to know by how much to reduce the power of the continuous signals in time for the slot boundary prior to the start of the ACK or NACK transmission, it would need to complete the CRC evaluation process more quickly than the time allowed by the timing of the ACK/NACK transmission.

According to the present invention, the MS reduces the transmit power at the timeslot prior to the start of the ACK/NACK transmission by an amount corresponding to whichever of ACK or NACK has the highest power requirement. In this way, the UE can ensure that enough transmit power is available for the ACK/NACK transmission regardless of the final outcome of the CRC evaluation process.

The principle is illustrated in Figure 1. In Figure 1 the MS is initially transmitting at its maximum allowed power, $P_{max} = P_{C1} + P_{D1}$.
Suppose that P_A is defined to be $2P_C$ and P_N is defined to be equal to P_C.

Then the powers of the DPDCH and DPCCH must be reduced such that

$P_{C2} + P_{D2} + P_A = P_{max}$

$P_{C2} + P_{D2} + 2P_{C2} = P_{max}$.

The power ratio between the control and data channels is maintained, such that $P_{D2}/P_{C2} = P_{D1}/P_{C1}$.

Thus $P_{C2} = \frac{P_{C1} + P_{D1} - P_A}{1 + P_{D1}/P_{C1}}$ or $P_{C2} = \frac{P_{C1} + P_{D1}}{3 + P_{D1}/P_{C1}}$

and $P_{D2} = \frac{P_{C1} + P_{D1} - P_A}{1 + P_{C1}/P_{D1}}$ or $P_{D2} = \frac{P_{C1} + P_{D1}}{1 + 3P_{C1}/P_{D1}}$.

In another embodiment, the additional signals may carry information other than ACK/NACK signalling; for example, they may carry packet data (as in the proposed enhanced uplink in UMTS) or other signalling information.

ABSTRACT

COMMUNICATION SYSTEM

In UMTS (Universal Mobile Telecommunications System) HSDPA (High-Speed Downlink Packet Access), it is necessary to scale down the uplink transmission power at certain times in order to allow sufficient power for essential uplink ACK/NACK signalling. This scaling may have to be carried out before it is known whether the transmission will be an ACK or a NACK, and consequently the power requirement is unknown. According to the present invention, the power scaling is carried out based on the power required for whichever of ACK or NACK requires the most power. This avoids reducing the amount of time available to the UE for evaluating the CRC used to determine whether ACK or NACK should be transmitted. This invention may also be applicable to power scaling prior to transmission of other signals whose exact power requirement is unknown at the time when the power scaling is applied.

(Figure 1)

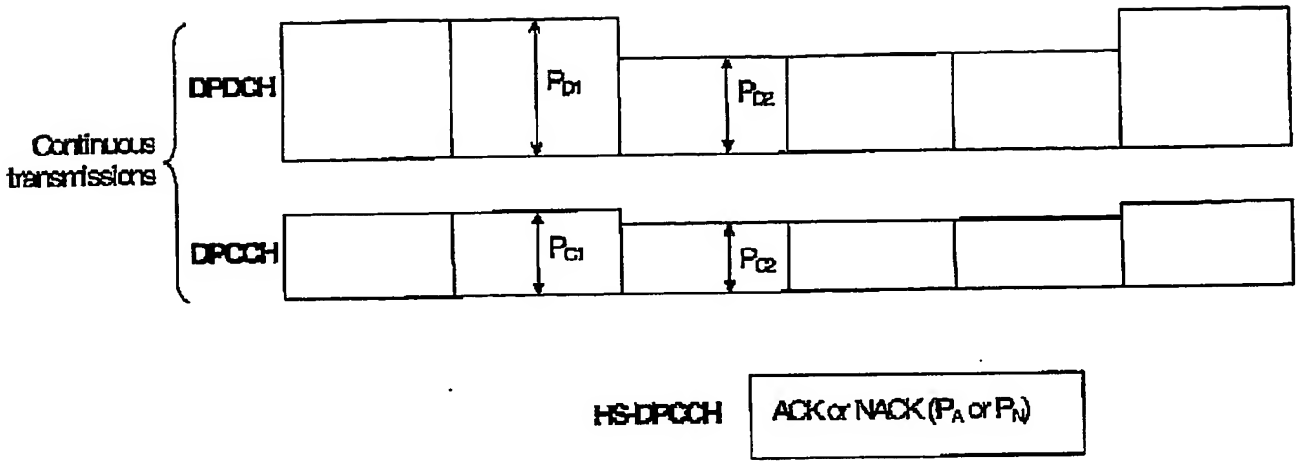
Continuous transmissions
DPDCH
DPCCH
P_{D1}
P_{D2}
P_{C1}
P_{C2}
HS-DPCCH
ACK or NACK (P_A or P_N)

Fig. 1